SCIENCE.

FRIDAY, MAY 22, 1885.

COMMENT AND CRITICISM.

As we look back at the literature of modern physiology, — a retrospect suggested by the recent appearance of an index to Pflüger's *Archiv für physiologie*, — two facts especially impress us: first, that the bulk of the researches comes from Germany; secondly, that modern experimental science is scarce over forty years old, but has developed in extraordinary crescendo. There is, perhaps, no other science so pre-eminently German, and to which other nations have contributed relatively so little. In Germany the first physiological laboratories were founded, and these have become important 'institutes,' which are the patterns other countries are now slowly imitating. In Germany the science first became strictly experimental, and its modern methods and aims were wrought out. The German universities have been the training-places of the majority of professional physiologists the world over, and these men have been the apostles of German influence.

Our indebtedness to modern physiology can hardly be over-estimated; for its acquisitions represent not only an invaluable intellectual evolution, but also knowledge of immeasurable utility in manifold practical aspects. It has changed medicine from a crude empirical art to an intelligent application of science, and has done more than any other cause to raise the mental status of the medical profession by inculcating the rational foundation of the practice of medicine. The chief initiatory impulse to modern physiology was given by the greatest of German biologists, Johannes Müller, — a man remarkable alike for his own intellectual achievements, and for the stimulus he imparted to others. He was one of the chief founders of the sciences of morphology, physiology, and comparative anatomy. His influence in physiology has been perpetuated by his distinguished pupils, notably the veterans, Ludwig, Helmholz, Brücke, and Du Bois Reymond, who are living to see two generations of followers. Thus the young physiologist of to-day might be called the great-grand-pupil of Johannes Müller.

The literature of physiology has grown with constantly expanding rapidity. At first the memoirs were scattered in numerous scientific and medical publications, but soon two periodicals acquired the lead as media for the announcement of physiological discoveries. Müller's own *Archiv* expressly included physiology in its scope, as did also the *Zeitschrift für rationelle medicin*, a journal of high scientific rank. It was long before there was any periodical exclusively devoted to physiology, Pflüger's *Archiv* not being founded until 1868. At first Pflüger's volumes were annual, but at present he issues nearly three volumes a year. Since then two other first-class physiological journals have been started in Germany. Hoppe-Seyler edits a new and successful *Zeitschrift für physiologische chemie;* and the continuation of Müller's *Archiv* has been divided, the physiological part now forming a separate annual volume. The annual report on the progress of physiology, giving abstracts only, alone makes a bulky volume, which shows, moreover, that nearly all the papers are in German. While the extraordinary development of physiology in Germany has been going on, what have other countries contributed? Very little. There are only two other physiological journals of any note, — one decidedly second-rate, in France; and another the outcome of the combined efforts of England and America, which, though excellent scientifically, is uncertain as to its viability. In short, the

world depends, now as formerly, mainly on Germany for the progress it makes in the knowledge of the functions of life.

"It is one of the melancholy things connected with publication in government reports," writes one connected with the government, "that your work appears so many years after it has been completed, that the author has in the mean time quite outgrown it, and developed into another stage of opinion and activity." This is not a matter of months only, but of years, and, though not so serious a difficulty as formerly, is still a great drawback to efficient and effective work. The administration of the public printing-office is such that every thing has to give way to congressional documents which are often of the smallest value. Is there no remedy for this uncomfortable state of things?

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Progress of vegetation in the Ohio valley.

The spring of the present year has been very late in the valley of the Ohio; so late, indeed, that nearly every one has said that it has not been so long coming for many years. A review, under these circumstances, of a record kept of the early-flowering plants for eight years, may be of interest. The first appearance of flowers is a more reliable indication of the state of the weather than the thermometer. Plants indicate the general average of climatic conditions; and the species, appearing in much the same sequence, indicate the progress of spring. In the table of fifteen species here presented, of the first flowers which generally appear, a number of facts are to be noted. It is to be noticed that every alternate year is a cold year, or one, at least, with a late spring. The years 1874, 1876, 1878, and 1884 are early ones, while 1875, 1877, 1883, and 1885 are late.

In 1874 eleven out of the fifteen plants were observed between March 19 and 26, a period of eight days; in 1876 nine out of the fifteen were seen between Feb. 12 and March 14, just a month; in 1878 the eleven of which there is record were found between March 3 and March 18, or sixteen days; while in 1884 the thirteen were recorded between March 16 and 30, or fifteen days. These were the early years. In 1875 fourteen out of the fifteen bloomed between March 30 and April 11, or in thirteen days; in 1877 two were out on March 4, none others until April 1, and between that and the 12th twelve came out; in 1883 two were out on March 4, one on March 13, and ten between April 6 and 12; lastly, in the present year the first flower did not appear until April 1, and thirteen others bloomed up to the 20th.

Account is here taken of only fifteen species. More than this number appeared during the time between the earliest and latest dates; but the ones here considered may be regarded as the *typical* early flowers. They represent eleven different orders.

The earliest year of the eight is 1876. In that year the spring cress (Cardamine rotundifolia) was in bloom Feb. 12, and the dandelion (Taraxacum dens-leonis), generally the earliest composite, on April 7. In 1875 the first flower, red elm (Ulmus fulva), was in bloom March 30, and the dandelion on April 29; while in the present year, in many respects the counterpart of it, the first flower, white maple (Acer dasycarpum), was out April 1, and the dandelion on the 26th. But even 1875, the latest of all, was, on an average, six days in advance of this year. This season is, then, nearly a week later than any in eight recorded years, and is seven weeks and two days behind the earliest year (1876) of the same eight.

In scanning the list, it is further found that three out of these fifteen early flowers are trees; nine of the remainder are provided with bulbs, tubers, or rhizomes, in which nourishment is stored up; one (Anemone acutiloba) has persistent evergreen leaves; and only the remaining two (Capsella and Taraxacum) seem to have no special fund upon which to draw. The importance, then, to herbs, of a store of matter

Species.	1874.	1875.	1876.	1877.	1878.	1883.	1884.	1885.
Acer dasycarpum	–	4-4	2-26	4-1	3-8	3-4	3-23	4-1
Symplocarpus foetidus	4-19*	4-6	2-13	3-4	3-3	3-4	3-18	4-5
Erigenia bulbosa	3-26	4-6	2-13	4-1	3-3	4-8	3-16	4-5
Anemone acutiloba	3-19	4-6	4-2*	4-1	3-8	4-6	3-23	4-12
Sanguinaria Canadensis	3-29	4-8	–	4-1	–	4-12	3-24	4-12
Ulmus Americana	3-22	4-4	2-27	4-1	3-8	4-6	3-16	4-6
Ulmus fulva	3-19	3-30	2-27	4-1	3-10	4-6	3-28	4-10
Cardamine rotundifolia	3-22	4-7	2-12	3-4	3-8	3-13	3-23	4-18
Erythronium albidum	3-26	4-8	3-14	4-12	3-18	4-12	3-23	4-18
Claytonia Virginica	3-22	4-6	2-13	4-1	3-8	4-8	3-24	4-18
Capsella bursa-pastoris	3-22	4-7	4-2*	4-2	3-10	4-13	3-30	4-19
Anemone thalictroides	3-22	4-7	3-12	4-1	3-10	4-6	3-27	4-19
Dentaria laciniata	4-6	4-11	4-2*	4-7	–	4-12	3-30	4-20
Jeffersonia diphylla	4-20	4-11	–	4-8	–	–	–	4-20
Taraxacum dens-leonis	4-19	4-29	4-7	4-15	–	–	–	4-26

* These were probably in bloom at an earlier date than this; but they are so recorded in my note-books, and were seen first on the dates given.

which can be speedily utilized at the first opportunity, is here well shown. JOS. F. JAMES.

Cincinnati, April 28.

Prehistoric fishing.

In Professor Rau's interesting work on prehistoric fishing is a series of Indian bone and horn fish-hooks, ending with a figure that I sent him of one found on an early site on the line of Onondaga county, N.Y. I was especially interested in this object; because it was the first thing found there that seemed to show any knowledge of Europeans, although the site was connected with later sites, near by, by several peculiar relics. The general form of the hook, with its distinct barb, was so like some of the present day, that I naturally thought the Indian maker had at least seen a white man's hook. The series in Professor Rau's work gave rise to doubts, as the main difference in this and others figured was in the barb. I was thus led to see the force of Dr. Rau's remark in his introduction: "I would not venture to say that barbed fish-hooks had been unknown in America in ante-Columbian times; I simply state that none have fallen under my notice."

In looking over some drawings of relics made about three years ago, my attention was arrested by one which I had labelled 'horn perforator.' The more I looked, the more the conviction strengthened that it was the barb of a fish-hook. Borrowing the fragment, I drew it again, after careful examination, and then sent the fragment to Dr. Rau for inspection. He says, "It certainly has the appearance of the barb of a fish-hook." The fragment is one inch and five-sixteenths long by about one-twelfth of an inch thick; from the point to the present end of barb, fifteen-sixteenths of an inch; while the width at the barb is about five-sixteenths; that of the shank, one-eighth of an inch. It is very sharp. There seems to have been a defect in the material, which caused the sharp point of the barb to break off, and which weakened the hook itself. This came from an early site where I have gathered many articles myself, and all are clearly prehistoric. The large copper spear figured by me for Dr. Abbott's 'Primitive Industries' came from the same field.

Yet I think the New-York Indians seldom used hooks. All the early references are to fishing with nets and spears; and our Indian village sites are seldom on the shores of deep lakes, almost always by streams, or near the shallow rifts of rivers. Stone fish-weirs are not uncommon, probably used as they were farther south. One of three deep bays which I measured was a work of great magnitude. Nets were much used, and I have found the flat sinkers on sites far away from the water. These were small, however. The large ones, measuring six to seven inches across, I have only found on the river-bank.

A small cylindrical sinker of brown sandstone, grooved around the centre, was probably used on a line. The ends are rounded. A rough tube of copper, two and a half inches long by three-fourths in diameter, found by the Oneida River, I have thought might have been attached to a line, as well as the polished stone plummets.

The polished slate arrows of the Seneca and Oswego rivers, and of one part of Lake Champlain, I think may prove to be fish-knives, being much like a double-bladed knife of broad form. They would have been admirable for opening and skinning fish, had savages been so fastidious. W. M. BEAUCHAMP.

The ruddy glow around the sun.

In November, 1883, at the time of the remarkable after-glows, I noticed that there was a broad, reddish ring around the sun even at mid-day. Soon after, I briefly described the appearances in *Nature*. Since then, I have constantly observed this phenomenon. The sky is very bright for about ten degrees from the sun; then comes the ruddy zone about twenty degrees wide, the deepest color being at about the natural distance of halos. My observations show that at this place there are but few days of the year when the chromatic glow is not visible; but it varies in intensity not only from day to day, but even from hour to hour. About a year ago I discovered that an increase in the depth of color preceded a fall in the temperature, and the formation, first of a structureless haze in the upper atmosphere, and, soon after, of cirrhus-clouds. At other times storms came on with no increase in the depth of color. Soon it became evident that the latter cases were when rain fell, and the general temperature was not low. Hail and sometimes snow storms were accompanied by great depth of color. During the summer of 1884, I passed several weeks in Maine. On two occasions the colored zone appeared around the sun as distinctly as it ordinarily does here. Both times the appearance of the glow was followed by violent thunder-storms, with high winds and *hail*.

While temperature would not affect the diffractive power of particles of volcanic dust directly, yet it is possible that at a low temperature the dust particles, on account of the condensation of the air, may be enough nearer to each other to give a perceptibly greater diffractive power to the mass of air in which they are suspended. But so often has an increase in the depth of the circumsolar glow preceded the formation of clouds, that it seems far more probable that the glow is caused by the precipitation of atmospheric moisture at low temperatures. If dust is involved in the process, it is probably only by its increasing the depth of color, or by its facilitating the precipitation of moisture.

In substance, these views have been expressed verbally to numerous persons for more than a year past. They are published now not merely as a matter of theoretical meteorology, but also for a practical purpose. The observations here recorded make it probable that the glow may be utilized as a prognostication of hail. It goes without saying, that it will be of great value to many, especially to those who have much exposed glass on the roofs of greenhouses, etc., to be able to predict hail and a fall in the temperature. It is true that other localities than those named may not show the same phenomena. The subject is worthy of the careful study of the signal-service, and of meteorologists generally.

G. H. STONE.

CARL THEODOR VON SIEBOLD.

THE death of Carl Theodor Ernst von Siebold, the last survivor of three distinguished brothers, deprives Germany of one of her most honored men of science. His investigations had ceased, owing to illness and the encroach-

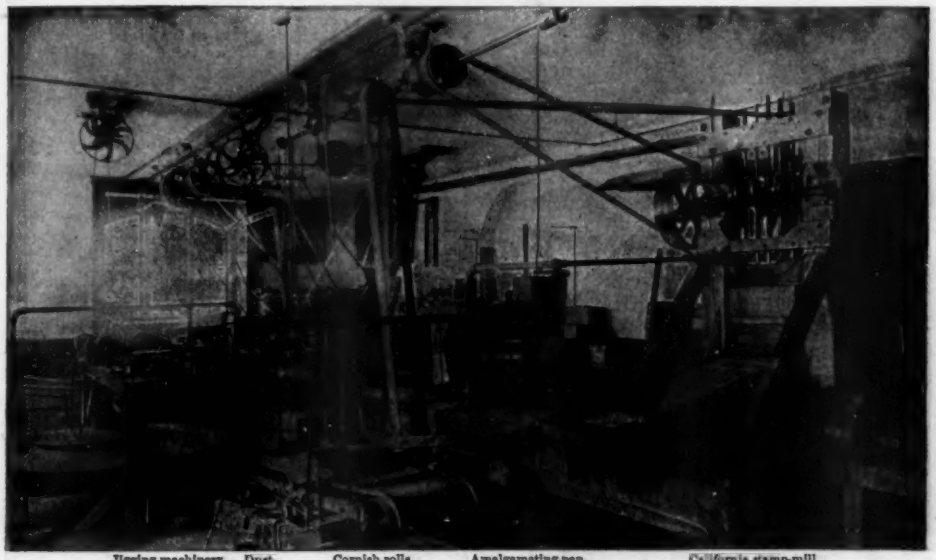
ments of age, some time before his death; but his career is a long record of discoveries. He was born at Würzburg, Feb. 16, 1804. His elder brother, Eduard Kaspar Jakob, was a prominent obstetrician, holding a professorship at Göttingen at the time of his death. His still older cousin, Philip Franz (not a brother, as sometimes stated), became distinguished by his very successful scientific journeys in Japan and the Indian Archipelago. Carl Theodor, like Helmholz, and many another of the older German men of science, was educated as a physician, and began life with the practice of his profession, at first in a governmental post as a 'kreisphysikus' in Heilsberg for a year, next as director of the lying-in hospital at Dantzig. In 1840 he definitely entered upon a university career as professor of physiology at Erlangen; and, after several changes, he went to Munich in 1853, and there remained until his death, on the 7th of last April.

His original work has been almost entirely in the field of zoölogy, more especially in the domain of comparative anatomy. His manual of this last-mentioned science is a great masterpiece, a model of truthful and critical compilation, supported by numerous original observations. In this work an immense array of facts are properly co-ordinated, and the whole concisely presented. It is not too much to say of this publication, that it has never been surpassed as an adequate exposition of the contemporary knowledge of comparative anatomy. Siebold's own investigations have been very numerous. His researches on the development of the intestinal worms, and also those on parthenogenesis, opened new fields of thought, and the first-mentioned were of great practical utility to mankind. His monograph on the fresh-water fishes of Europe is the standard authority on the subject. Together with Kölliker, he founded the famous *Zeitschrift für wissenschaftliche zoologie*, a journal of the very highest character. The museum at Munich, of which he had charge, is a beautiful monument to his scientific and judicious administration. Such, in brief, are the long-continued and successful labors of one of the most esteemed veterans of German science, of one whose work and influence have contributed much to give Germany of to-day the intellectual leadership of mankind.

THE NEW MINING LABORATORY OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

BEFORE the era of railroads there was comparatively little demand for technically educated engineers; and those who were classed as such were either self-made men, or men who, after a college course, had studied engineering from a special liking for the profession. This process of selection brought forward many of the best engineers the world has ever seen; but the time of preparation for work extended over a period of some six to eight years. The almost incredibly rapid development of the railroad and of manufacturing and mining industries has created, within the past twenty-five years, a demand for engineers which cannot be met by the comparatively slow methods of former years. In response to this demand, schools have sprung up, most of which aim to prepare young men, by a four-years' course, to become engineers. As a natural result, there has been a rush of young men to these schools, in the expectation of finding lucrative positions open to them immediately upon graduation.

Perhaps one man in four selects a given course because he knows exactly what he wants to do. The other three have no special bent, and therefore follow their classmate's lead. The duty devolving upon the school is consequently to instruct to the best advantage the students of both classes in order that they may meet the world's demand. There is room in the field of discovery and enterprise, not only for the Siemenses, the Bessemers, and the Holleys, but for an army of intelligent managers of works and their assistants. The student who has it in him to become a Siemens or a Bessemer will educate himself, with the help of a school, or without it maybe; but the three-fourths of a given class who are to become a most important feature in the success of the works to which they go, must be aided to form a special bent for themselves.



Jigging machinery. Evans table. Dust-fan. Cornish rolls. Frue vanner. Amalgamating pan. Amalgamated copper plates. California stamp-mill. Ball mill amalgamator.

MILLING-ROOM.

The methods pursued in all the engineering courses of the Massachusetts institute of technology for accomplishing the above object are well illustrated in the department of mining engineering and metallurgy, which has recently enlarged and refitted its laboratories. The plan is to assign the maximum amount of time possible in a four-years' course to the usual mental training for the profession, including the principles of chemistry, physics, mathematics, and modern languages, — all of them subjects best learned at school, — together with an amount of laboratory-work as small

in quantity as will successfully accomplish the following purposes: namely, first, to illustrate, amplify, and explain the use and bearing of the theoretical training; and, second, by some actual experience to eradicate the conceit and superficiality which so often follows from book-knowledge only, and in this way to give the student a suitable introduction to the world. Experience shows that this course gives a student an insight into the bearing and use of much of his mental work, and serves as an initiation to his profession where competition is sharp, and only the most teachable and industrious can survive.

The new mining laboratories have an area of floor-space of between five and six thousand square feet. They are furnished with apparatus for the mechanical preparation of ores for furnace-work, for lixiviation, and for assaying, each of these subjects being assigned a separate room. The machines and furnaces are arranged in a manner which an experience of thirteen years has shown to be the best for the class-work of students. While in a large establishment it is desirable to have as many as possible of the machines run automatically, in a laboratory for instruction it is desirable, on the other hand, not to have the machines and furnaces run automatically, else the students will fail to gain the very experience which they need.

When the students begin their work on ores in the last year of their course, they are already practised analysts, having had a three-years' training in the chemical laboratories, and a course in assaying. They are already looking toward actual work in eight months' time, and they fully appreciate the opportunity given them to make a somewhat intimate acquaintance with the tools and processes of the professions they hope to follow.

Water jacketed furnace for copper or lead. Slag-kettle. Lead reverberatory furnace. Lead-kettle. Copper-refining reverberatory furnace.

FURNACE-ROOM.

A few examples of investigations which have been made will suffice for illustration. Two students were given gold ores to treat. The first one had an ore from New Hampshire weighing 4,440 pounds: the second had an ore from Nova Scotia weighing 1,400 pounds. The problem given them to solve in the case of each ore was as follows: 1. Is the ore a free-milling ore? 2. Is the gold in a fine, or coarse condition? 3. How many amalgamated plates are needed to catch the whole of the

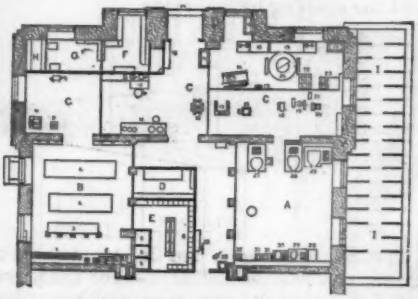
gold? 4. Will there be much waste in treating the ore? 5. If so, how much, and what means should be adopted to avoid it?

The rock was crushed fine in a stamp-mill, and the fine sand was conducted by the agency of water over a series of amalgamated copper plates, by which any active or free-milling gold was taken up, and the passive, rusty, included gold was allowed to pass on, together with the sand. This sand, before going to waste, was treated on a concentrator; and from the product or concentrate the greater part of escaped gold could have been extracted by chlorine.

The yield of gold per ton was as follows: —

	Nova-Scotia ore.	New-Hampshire ore.
	Coarse nuggets.	Very fine grains.
Gold in the amalgam of the stamp-mill	$13.040	$2.28
Gold on the first plate	0.200	1.35
Gold on the second plate	0.010	0.11
Gold on the third plate	0.030	0.09
Gold on the fourth plate	0.007	0.05
Gold on the fifth plate	0.002	0.03
Gold in the concentrates	0.150	0.37
Gold on the additional mercury trap	–	0.02

From these experiments the students ascertained that the Nova-Scotia gold is very coarse, is almost all saved in the stamp-mill, and less



A, furnace-room; B, assay-room; C, milling-room; D, supply-room; E, toilet-room; F, private laboratory; G, office; H, balance-room; I, vaults; J, entrance to vaults.

than five plates will answer for treatment, and that the concentrates yield very little additional gold; while New-Hampshire gold is quite fine, is not much more than half saved in the stamp-mill, that five plates are not enough, and if the series were continued to eight or ten the last would probably more than pay for itself, and that considerable gold is saved in the concentrates.

A third student had a lot of galena weighing one ton to treat for lead, silver, and gold. Aided by his classmates, he crushed the ore, sampled, calcined, sintered, and smelted it, obtaining base bullion. He extracted the gold and silver by the zinc process, followed by cupellation. The silver-gold brick obtained was carefully valued, as were also all his products throughout the test. The losses in the process were, —

	Per cent.	*Per cent.*	*Per cent.*
In calcining	Lead, 5.	Silver, 2.	Gold, 0.
In smelting	Lead, 12.	Silver, 7.	Gold, 4.
In cupelling	Lead, 8.	Silver, 6.	Gold, 1.
Total losses	Lead, 25.	Silver, 15.	Gold, 5.

From the results, not only did he learn with his own hands and eyes where the greatest difficulties are to be encountered in lead and silver smelting, but also the familiarity with this process rendered his reading upon the smelting of copper, iron, and other metals, far more intelligible and real.

When work by day only is called for, there is enough of the spirit of investigation in nearly every student to carry him over the tedious part of his task for the sake of the results he sees immediately within reach. When the test lasts through the night also, as happens three or four times during the year, there is always enough of the savor of camping out to help keep up the interest.

SILVER FROM A PENNSYLVANIA MOUND.

SITUATED near the town of Irvine, Warren county, Penn., on a very pretty and fertile bottom of the Alleghany valley, are two mounds, well known for the last seventy years. No opening had been made in either in this time, except a shallow pit dug in the side of the smaller about fifty years ago. While spending a few days last summer in that region, I obtained permission of the very intelligent and courteous owner, Dr. William A. Irvine, to make a thorough exploration of them.

The smaller, which is on the bank of the river, near the point where it is joined by the Brokenstraw Creek, is circular, fifty-two feet in diameter, and three feet and a half high, but has evidently been considerably lowered and expanded by the plough, as the land has been under cultivation for at least sixty years,

and for some time previous thereto was occupied by a band of Seneca Indians.

The chief features of this mound, as shown in fig. 1, which represents a vertical section of it, are the pit and large central stone vault (No. 1). The former was found to be two and a half feet deep below the natural surface-line, *ab*, and about forty feet in diameter, the diameter probably indicating the original extent of the mound.

The upper portion of the vault had fallen in, wedging the stones so tightly together that it

Fig. 1. — Section of mound near Irvine, Penn.

was somewhat difficult to remove them; but the original form and mode of construction could easily be made out without the aid of imagination, as the lower portion was undisturbed. The builders had evidently miscalculated the proportions necessary for stability; as the diameter, from outside to outside, was fifteen feet, though the walls were very thick near the base, while the height could not have exceeded seven feet: hence it is probable that it had fallen in soon after the dirt was thrown over it. The stones of which it was built were obtained in part from the bed of the neighboring stream, and partly from a bluff about half a mile distant, and were of rather large size; many of them being, singly, a good load for two men.

The bottom was formed of two layers of flat stones, separated by an intermediate layer of sand, charcoal, and remains, five inches thick (at the time it was excavated). It was apparent that these layers had not been disturbed, save by the pressure of the superincumbent mass, since they were placed there. The intermediate layer was composed in great part of decomposed or finely pulverized charcoal. In this were found the teeth, decaying jaws, a single femur, and a few minute, badly decayed fragments of the bones of an adult individual, and with these the joint of a large reed or cane, wrapped in thin, evenly-hammered *silver-foil*. The latter had been wrapped in soft, spongy bark of some kind, and this coated over thickly with mud or soft clay. The weight of the stones was so great that the femur was found pressed into a flat strip, and the reed split. I was unable to determine certainly whether the burning had taken place in the mound or not. The few bones found did not appear to be charred, and the same was true of the cane-joint: on the other hand, the bark, although wrapped in clay, was very distinctly charred.

A careful analysis of the metal-foil has been made by Professor Clark, the chemist of the geological bureau, who pronounces it comparatively pure native silver, containing no alloy. Although wrapped around the cane, a portion of it appears to have been cut into small pieces of various shapes, two of which are represented in fig. 2, *a* and *b*. Where the margins remain uninjured, they are smoothly and evenly cut. The joint of cane which has been taken between the nodes is nine inches long, and must have been about an inch in diameter. A small stone gorget was obtained from the same layer.

At No. 2, on the north-east side of the pit, were a few large stones which may have formed a rude vault, but were in such a confused condition, this being the point disturbed by the first slight excavation, that it was impossible to ascertain their original arrangement. Among them were found parts of an adult skeleton. The person who dug into the pit at this point, finding human remains, stopped work, and refilled the opening he had made.

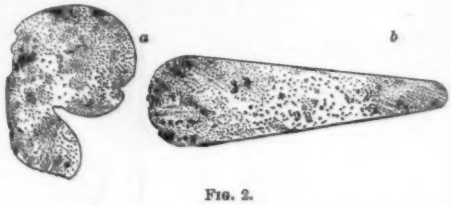


Fig. 2.

The Senecas, as I am informed by Dr. Irvine, who has resided here since 1822, protested that they did not know who built these mounds; which statement seems to be borne out by the fact that intrusive burials, probably of their dead, were discovered in the other tumulus. Cyrus Thomas.

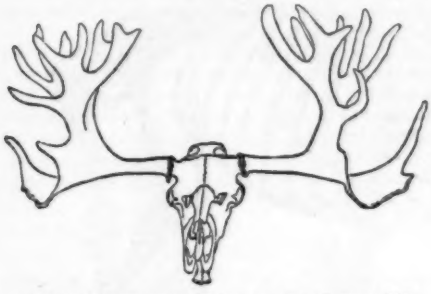
A FOSSIL ELK OR MOOSE FROM THE QUATERNARY OF NEW JERSEY.

Last summer Rev. A. A. Haines presented to the museum of Princeton college a remarkably perfect skeleton of a large elk or moose,

SKELETON OF CERVALCES. SCALE IS GIVEN IN FEET AND TENTHS.

found in a shell-marl beneath a bog, in Warren county, N.J. In all probability, this animal belongs to the same species as the specimen from the Big-Bone Lick, Kentucky, described by Wistar as a species of Cervus (*Proc. Amer. phil. soc.*, 1818, p. 376), and named Cervus americanus by Harlan in 1825. This specimen, which is now in the museum of the Philadel-

phia academy, consists of a broken cranium, some fragments of antlers, and two metacarpals. Assuming the correctness of this identification, a very short examination of the Princeton skeleton suffices to show that the species in question is most distinctly not a Cervus at all, but is much more like an Alces. It is, however, sufficiently different from the last-named form to necessitate the formation of a new genus for its reception. For this I have proposed the name Cervalces, which serves to indicate its relationship. The specific name given by Harlan must, of course, be retained, so that the full name will be Cervalces americanus.



HEAD OF CERVALCES FROM THE FRONT, REDUCED 1-25.

Cervalces was a very large animal, with large head, short neck and trunk, and exceedingly long legs (much longer than in the great Irish deer). The antlers are palmated, though far less so than in the moose, as in that form they have horizontal beams, no brow-antlers, and a dichotomous division of the tines; but they do possess, as the moose-antler does not, a bezantler, and a posterior tine given off from the beam opposite to it. These processes occur in the antlers of Dama (the fallow deer) and Megaceros (the extinct Irish deer). In Cervalces the two tines named are connected by a flaring process of bone, which descends below the level of the eye, and present a most peculiar type of antler, altogether different from any thing known in any member of the deer tribe.

The nasal bones are much longer, and the nostrils much smaller, than in the moose, showing that there was no such proboscis-like snout as in that animal. The premaxillae are shaped as in the stag, and join the nasals. The skull is broader and shorter than in the moose, and in many respects like that of the true deer. There are also cervine features in many parts of the skeleton, together with peculiar characters. Cervalces agrees with the moose, and differs from the stags, in having the lower ends of the lateral metacarpals present (Telemetacarpalia of Brooke).

Altogether, the fossil gives us much welcome light on the obscure relationships of the moose to the other members of the deer family, showing that that curious form was derived from a type very like Cervus, but having the lateral metacarpals complete throughout. Cervalces is not one of the steps of direct descent, but it shows what that descent must have been.

It is certainly a very remarkable fact that an animal which in quaternary times was probably most abundant in this country should be represented in the collections by only two specimens. The superb specimen at Princeton is practically a perfect skeleton; for, except two or three caudal vertebrae, the few missing bones are represented by their fellows of the opposite side. The skeleton has been most skilfully restored and mounted by Curator F. C. Hill. A full description, with plates, will shortly appear in the Proceedings of the Philadelphia academy.

W. B. Scott.

Geological museum, Princeton, N.J.

GEOGRAPHICAL NEWS.

Rev. William E. Fay of the west central African mission contributes three small maps of the route between Benguela and Bihé to the *Missionary herald*. The trail was surveyed with a prismatic compass, the distances determined by the pedometer, and altitudes along the line checked by observations for the boiling-point. The route was passed over four times; and the maps, while confessedly approximations only, form a distinct advance over the reconnoissance made by Cameron, which, up to the present time, has been the only authority for this region. The new sketches cover an area about sixty miles wide north and south, and extending some four degrees in longitude. The changes of scenery between Benguela and the interior are numerous and striking. First, the route passes along the level sands of the coast, under a tropical sun. From Catumbella it strikes inland, ascending the highlands at once, and traversing a rocky desert which separates the coast from the fertile lands beyond, rich in tropical verdure. Still ascending, the well-remembered features of the temperate zone are seen on every side. Descending, at the eastern foot of the range are the first human habitations. About one hundred miles from the coast, the Bailombo River, in wet seasons, is spanned by a native bridge, whose builders take toll, as in more civilized lands. The mission village lies in about east longitude 16°, and south latitude 12° 15′, south-east from the *ombola* of Kwikwi, ruler of the Bailundu region. This is a broad and beautiful valley, densely populated, and lying eastward from a

region of mountains estimated to rise in peaks of from five to eight thousand feet, the source of numerous important rivers, whose mouths are often separated by great distances, and whose courses trend to almost every point of the compass, from the mountain reservoirs where they take origin.

Late advices from Zanzibar state that the four explorers sent to the Ussagara by the German colonization society have been very unfortunate. They halted between Mpuapua and Condoa, where one died. Dr. Peters and Herr Baumann, stricken with malignant fevers, were obliged to return to Zanzibar in a serious state, while the leader of the party was left alone on the spot in a condition of great destitution. Aid was immediately despatched by the German traders of Zanzibar, which, it is hoped, will ameliorate his condition.

Two other German explorers, the brothers Denhart, sent by the Berlin geographical society, had arrived at Zanzibar, where they were joined by Herr Schlumke, for the last five years an explorer with Dr. Fischer.

The party intend to visit Samburo Lake, and explore the region of the Borani Gallas, as well as to explore the geology and botany of the upper parts of Kilimanjaro and Kenia.

The death of King Mtesa is confirmed. Those interested in the civilization of the country believe his successor will be more likely to assist in the process than the late king, whose volatility and caprice more than undid the good resulting from his occasional favors. Mirambo, sometimes known as the negro Napoleon, is also dead. He was noted for his courage, great intelligence, and semi-civilization. His death is likely to plunge the population of a vast region into anarchy; for by his ability, in spite of his humble birth, he had brought into submission a large territory, and made all the neighboring sultans his vassals.

The Algerian fathers have selected a healthy spot for their mission on the west bank of Lake Tanganyika, at a village called Chonsa, in about latitude 7° 30′. The natives are friendly, and the country a safe one.

Lieut. Becker's expedition had not started, and the difficulty of getting a sufficient number of porters was very great. This seemed due to the famine, which continues to desolate the interior, and to the uncertainties connected with matters in the basin of the Kongo.

A rumor has reached Paris through Bolivia, from the Gran Chaco region, that certain country-people, travellers in the interior, had found in the forest bits of paper and linen on which one of the Crevaux party had written his name in blood, together with an appeal for succor, and the statement that he had been spared by the Tobas on account of his skill as a musician, and had been obliged to follow the band which held him captive in all their wanderings since the massacre. The story, which has found a place in the printed proceedings of the geographical society of Paris, is, nevertheless, probably an invention of the 'travellers in the interior.'

An important journey has recently been made by a party commanded by Feilberg on behalf of the Argentine Confederation. Their object was to explore the trade-route between that country and Bolivia *via* the Pilcomayo. They comprised sixty-two men, with flatboats towed by two small steamers, and were absent fifty-five days. The actual distance in a direct line was probably forty-five leagues; but, taking the sinuosities of the river into account, the party travelled about eighty leagues. Up to this point, the navigation was not bad except for snags and sunken tree-trunks in the channel, but here it became impossible on account of a series of rapids which descend over a rocky surface with only a few inches of water, though the river was in flood. The question of a trade-route by this way is therefore definitely settled in the negative. The party found that below the rapids, sixty leagues above the mouth, a large affluent came into the Pilcomayo, with as much water, or perhaps even more, but which is not found on any chart. It was obstructed by sunken trees, but otherwise showed no impediments, and was ascended for twelve leagues. Feilberg hopes to explore it farther. The country along these rivers appeared healthy, and rich with fine pasturage. It appears now to be certain that the only feasible trade-route will be one carried overland.

THE AMERICAN FISHERIES SOCIETY.

THE fourteenth annual meeting of this society was held in the lecture-room of the National museum at Washington, May 5–7; the president of the society, Hon. Theodore Lyman, in the chair. The attendance throughout was fair, and the papers were, for the most part, exceedingly interesting. The roll of membership now includes about a hundred and fifty names, twenty-four new members having been elected during the meeting.

Prof. R. E. C. Stearns read a paper on the giant clams of Puget Sound. He referred to Glycimeris generosa as the 'boss clam' of North America. It was first described by Dr. Augustus A. Gould from specimens (probably of the shells only) obtained by the Wilkes exploring expedition, 1838–42. The distribution of this clam extends southerly along the west coast of America to San Diego, where it has been found by Mr. Hemphill; and it is more abundant in its northern than in its southern habitat. It is an excellent article of food, and is called by the Indians *geoduck*. It has been known to attain a weight of sixteen pounds, and a length of from one and a half to two feet.

A paper by Dr. James A. Henshall, on the hibernation of the black bass, was read by Mr. Mather. The writer advanced the theory that hibernation was a voluntary act, and did not necessarily involve a state of profound torpidity. He admitted that other fish were active in the same waters where black bass were hibernating, but accounted for this by saying that there was no supply of food for the bass. In the

extreme south, where crawfish were abundant, it did not hibernate; so that he considered hibernation to be the result of lack of food, rather than of temperature. Mr. Goode, in discussing this paper, regarded hibernation as purely a matter of physical cause and effect, holding that the hibernation or non-hibernation of the black bass in a given latitude depended entirely upon the temperature of the warmer retreats accessible to the fish. Black bass always hibernate in shallow bodies of water in cold climates.

Mr. Fred. Mather, in a paper on smelt-hatching, gave an account of some experiments in hatching the smelt Osmerus mordax, which seemed to indicate that quiet, almost stagnant water, and the presence of slime and fungus, were beneficial rather than detrimental to the proper and rapid development of the eggs.

Mr. F. W. True read a paper on the porpoise fishery of Cape Hatteras. This fishery was regarded as in its infancy in this country, and capable of great development if the animal could be taken in sufficient quantities to secure the introduction of its oil and leather into the markets. The company recently formed at Cape Hatteras by a party of Philadelphia capitalists hoped to utilize the meat of the porpoise for food. It is estimated, that, at the close of the present season, not less than four thousand porpoises would have been captured by this company. Mr. Goode thought, that, if the flesh could in some way be divested of its oily taste, it might be a very palatable article of food. He had while in London, in 1883, tasted some whale-flesh (put up in Norway in hermetically sealed cans), and spoke of its resemblance in flavor to beef *à la mode*. The oil he considered superior, for lubricating-purposes, to any other animal oil, but thought that its present high price would prevent it from coming into general use. He also said that in Europe boots made from porpoise leather were held in high esteem, and cost from fifteen to twenty dollars a pair. He considered the leather as most desirable for belting and lacing purposes. Mr. Lyman expressed his belief that the products of the porpoise fishery might be made of considerable commercial value, provided the animal could be taken in sufficient quantities.

Mr. Frank N. Clark gave some results of artificial propagation and planting of white-fish in the Great Lakes.

Mr. A. Nelson Cheney submitted a paper entitled 'Does transplanting affect the food or game qualities of certain fishes?' This was followed by a paper by Mr. J. S. Van Cleef, on 'How to restore our trout-streams.'

Dr. Tarleton H. Bean exhibited a nearly complete series of salmon and trout of North America, showed a species of Oncorhyncus, Salmo, and Salvelinus. He said that the species could be, for the most part, very well identified by a single character. In the genus Oncorhyncus, O. chouicha might be known by its very large number of branchiostegal rays, and the numerous pyloric coeca; O. nerka, by its large number of gill-rakers, usually about forty; while none of the other species have more than twenty-seven. O. kisutch has but few pyloric coeca, — seventy to eighty. O. gorbuscha has very small scales; so much smaller than any other species of this genus, that this character alone will suffice to distinguish it. O. keta, the last species, resembles O. chouicha in most respects, but has a smaller number of branchiostegal rays.

The species of Salmo are easily divided into two groups, one of which has hyoid teeth, the other having none. Of the first group there are two small-scaled species, — S. Gairdneri; and its fresh-water form irideus, in which the scales are never in more than a hundred and fifty longitudinal rows. The small-scaled form S. spilurus, with its offshoot S. pleuriticus, has sometimes as many as two hundred scales in the longitudinal series. The group with hyoid teeth includes Clark's trout, S. purpuratus, with its varieties, Bouvieri, stomias, and Henshawi.

The species of Salvelinus divide themselves into two great groups, the first of which has a tooth-bearing crest on the vomer. This is represented by namaycush and its variety siscowet. All of the other Salvelini are red-spotted, and have no crest on the vomer. These are again divided into two great classes, one having hyoid teeth, and the other having none. The Salvelini with hyoid teeth are oquassa, naresi (which is a near relative of oquassa), arcturus (the most northerly salmonoid known), malma, the Pacific red-spotted char, and salvelinus (which has been introduced into New England from Bavaria). The group without hyoid teeth includes fontinalis, known in the searun condition as immaculatus, and in its northern habitat varying into hudsonicus of Suckley. It is a giant in this genus, reaching a weight of fifteen pounds. This Labrador form has a larger number of gill-rakers than the common fontinalis, and there seem to be fewer tubes in the lateral line; so that we may be obliged to consider it as a species distinct from fontinalis. The last species of this group is S. stagnalis, a Greenland species, which reaches a large size, and is distinguished by its greatly elongate form.

The three species recently introduced from Europe into America are Salvelinus salvelinus (already mentioned), Salmo levenensis (the Loch Leven trout of southern Scotland and northern England), and Salmo fario (the river-trout of central and northern Europe and England).

The species of Salvelinus, both eastern and western, attain their greatest development in the northern portion of their habitat. Thus the S. malma of the west coast is represented in the national museum by examples more than two feet in length from Alaska; and the Labrador form of the eastern brook-trout bears more resemblance in size to a Maine salmon than to any thing else. Another noticeable fact about our salmonoids is that almost all of the western forms are black-spotted, while all but one of the indigenous eastern forms are red-spotted.

Col. McDonald, in a discussion of the 'Objective points in fish-culture,' presented an argument for a more extended application of the methods of scientific research, showing how exceedingly valuable to fish-

culture would be a more perfect knowledge of embryology, of the physical conditions of the waters, and the influence of temperature upon the movements of fish, etc.

Mr. W. V. Cox gave the audience a 'Glance at Billingsgate,' describing the location and general arrangement of this celebrated fish-market, and the daily methods of transacting business. He called attention to the fact that there was a great need for the introduction of a system of cold storage similar to that employed in the United States.

Mr. Fred. Mather gave an account of his work at Cold Spring Harbor. Statistics were presented showing the numbers of the various species hatched out under his direction, and a brief explanation as to his methods of operation was added.

Mr. Eugene S. Blackford read a paper on the oyster-beds of New York, containing a very instructive account of the present condition of the oyster industry of New York. In the course of his remarks, it was made to appear that the supply of oysters was much greater at present than ten or twelve years ago, and that, by a careful continuance of the methods of protection and planting, there was not the slightest doubt that the most successful oyster industry in the world would become developed in the waters of Long Island Sound.

Mr. John A. Ryder presented a paper on some of the protective contrivances developed by, and in connection with, the ova of various species of fishes. He classified the eggs of fishes into four divisions, — 'buoyant,' 'adhesive,' 'suspended,' and 'transported;' this last including such eggs as are hatched in the mouth, or in receptacles especially developed on the outside of the abdomen, or under the tail of the parent fish (usually the male), such as are hatched in nests built by the males, or are viviparously developed in the ovary or the oviduct of the mother. The egg of the cod was the type of the first division, buoyant, but without an oil-drop. The egg of the Spanish mackerel, bonito, cusk, and many other marine fishes, is buoyant, and with an oil-drop opposite the germinal pole, where the embryo develops. The second group was represented by the egg of the goldfish, which adheres singly to plants and weeds. The blennies lay eggs in radiating, adherent groups. The gobies, gobieso, yellowpeids, and many other forms, belong to this group. As an example of 'suspended' eggs, he referred to the common oviparous ray, which has four filamentous horns, one at each corner, which wind around plants, and suspend the eggs to weeds; so that as the tide sweeps by these horns, which have openings in them, fresh water is carried into the egg-case to aerate the embryo, and favor its incubation. In the Scombresocidae the entire egg-membrane is covered with strong filaments, which intertwine with those of contiguous eggs; and thus masses of eggs are suspended, sometimes several inches in length. The Apeltes, or four-spined stickleback, was cited as an example of the fourth group. The male has a pouch on the right side of the rectum, from which is poured out a viscid secretion, and which is spun out into threads fitfully by the animal, as he goes round a bunch of waterweeds, like a bobbin, to build a little basket-like nest for the eggs. Callichthys also builds a nest, while Antennarius and fishing-frogs of the deeper ocean deposit their eggs on masses of sargossa-weed. Reference was made to the number of salmonoids that prepare beds for the better protection of their eggs. This was also done by the black bass, sun-perch, and lampreys.

Prof. O. T. Mason, in a paper describing the use of the throwing-stick by the Eskimo in fishing, said that the most interesting of modern ethnological studies is the tracing of human arts from their birth through the different stages of their evolution. Many savage devices live on in civilization; but there is one, the Eskimo throwing-stick, which is not only one of the most ingenious of aboriginal devices, but one which has not survived in more highly cultured peoples. An account was then given of the manufacture, use, and distribution of this implement.

Professor Theodore Gill presented a paper entitled 'The chief characteristics of the North-American fish fauna.' He restricted his remarks to the fresh-water forms alone. He described America north of Mexico as a primary, terrestrial-aquatic realm, variously designated as the North-American, nearctic, and Angiogaean region or realm. It is one of the very richest in fresh-water types, more than six hundred species living exclusively, or nearly so, in the rivers and lakes. These species represent a hundred and fifty genera, and about thirty-five families. The North-American fish fauna may be segregated into two primary categories: 1°, arctogaean, including those families which are shared with Europe and northern Asia; and, 2°, those peculiar to this continent, which are the Amiidae, Hyodontidae, Percopsidae, Amblyopsidae, Aphredoderidae, Elassomidae, Centrarchidae, and several sub-families, as the Etheostominae, Hoplodinotinae, and Hysterocarpinae. Of the fresh-water species and genera of most of the families, some are anadromous; others inhabit salt and fresh water almost indifferently; and still others are catadromous, as the eel, which appears to breed only in the sea. The number of genera common to Europe and North America is extremely small. It is noteworthy that the number of the types peculiar to America are distinguished by the care which the parents take of their young, whereas the European forms are generally indifferent. The care of the eggs and young seems to be accompanied by an apparent diminution of the number of eggs; and in this respect there is a kind of analogy between fish-culturists and parents. The fish-culturists assume the part which, in nature, is exercised by the attentive parent; and the eggs and young, being provided for, stand less danger of destruction, and consequently in such the ratio between the eggs laid and fertilized, and the young matured, is very much less than that between the number of eggs of indifferent parents, and that of other progeny matured.

On Thursday, at noon, the members of the society, through the courtesy of Professor Baird, went on the U. S. fish-commission steamer Fish-hawk, for a trip down the Potomac River, to visit the shad-hatching

station at Fort Washington, and some of the Potomac fishing-shores. Col. McDonald, in charge of the fish-hatching station, displayed the apparatus for, and explained the process of, hatching shad and herring eggs at all the various stages. After the roe is taken from the fish and cleaned, it is put into glass tanks, through which the water is allowed to flow constantly. About forty-eight hours are required to hatch out the eggs. A shad a day old looks like a hair with two black spots attached to the end. When two days old, they measure about one-fourth of an inch in length. In twelve days the whole body is distinguishable. The spawn are not, as a rule, kept at this hatching-station more than thirty-six hours; at the end of which time, just previous to hatching, the eggs are placed in crates, and brought to the principal station at the armory building, near the national museum, where the final stages of incubation occur. The commission has this year hatched five million shad-eggs. The herring yield has been much larger, as the catch of this fish in the Potomac has been unusually abundant; nor are so many eggs of the herring destroyed during the process of hatching as of shad. The commission employs eighteen men at Fort Washington, who are constantly kept busy preparing the spawn and eggs for transportation. The day before the party visited this station, sixty thousand shad-eggs were taken. After the hatching process had been explained to the visitors, they were summoned to refreshments, which had been provided in one of the frame buildings belonging to the commission. The principal dish was 'planked' shad. By this process four fish are fastened to a board, and held towards a hot fire. Whilst cooking, the fish are constantly basted with a preparation made of butter, salt, and other ingredients. At a meeting on board the vessel, the commissioner of agriculture made some remarks on fish-culture in the west, and Col. Marshall McDonald offered an address on our fishing interests in general, and the work of the society in particular.

The following officers were elected for the present year. President, Col. Marshall McDonald, Washington. Vice-president, Dr. William M. Hudson, Hartford, Conn. Treasurer, Eugene G. Blackford, New York. Corresponding secretary, W. V. Cox, Ohio. Recording secretary, Fred. Mather, New York. Executive committee, G. Brown Goode, Washington; F. L. May, Fremont, Neb.; Roland Redmond, New York; J. A. Henshall, Cynthiana, Ky.; Frank N. Clark, Northville, Mich.; S. G. Worth, Raleigh, N.C.; George Shepard Page, Stanley, N.J.

INLAND NAVIGATION OF EUROPE.[1]

The lower parts of the chief rivers of the United Kingdom are mostly arms of the sea, navigable at high water by ships of the largest burden. The principal waterway, the Thames, is navigable for about 194 miles, and is united by means of a grand network of canals with the Solent, the Severn, the Mersey, the Humber, and the Trent, being thus in direct communication not only with the English and Irish channels, but also with every inland town of importance south of the Tees. The estimated length of inland waterways in the United Kingdom is 5,442 miles, which has been constructed at a cost of £19,-145,866.

Russia's principal highway is the Volga, the largest river in Europe, which affords, with its tributaries, 7,200 miles of navigation. Hitherto no permanent works have been undertaken to improve the navigation of the Volga, but dredging has been resorted to in the lower part of the stream; and recently a system of scraping by iron harrows has been employed, which has doubled the depth of water over certain shoals in a few days. Other important water communications in Russia are the Caspian; the River Don, 980 miles in length; and the Dnieper, with a course of 1,060 miles. Of secondary rivers, the Bug, the Dniester, the Duna, and the Neva are all navigable. In the case of the latter short but most important means of communication, a maritime canal 18 miles in length has recently been completed to unite Cronstadt with St. Petersburg. About 900 miles of canal have been constructed in European Russia. In most instances they have been built to connect the head waters of rivers which had their outlets at opposite extremities of the continent.

Sweden abounds with lakes; but none of the rivers are navigable except those which have been made so artificially, nearly all of them being obstructed by cataracts and rapids. Nevertheless, Sweden possesses remarkable facilities for internal navigation during the seven months that the country is free from ice, intercourse being carried on by means of a series of lakes, rivers, and bays connected by more than 300 miles of canals.

Germany owns parts of seven river-valleys, and three large coast-streams. Of these, the Weser is the only one which belongs wholly to Germany, while of the Danube but one-fifth part runs through her territory. The inland navigation of Germany is of the most advanced character, an immense trade being carried on by means of barges and rafts. In the case of the Elbe, the system of towing by submerged cable has taken a large development. As early as 1866 chain-tugs were running on 200 miles of its course; and in 1874 this mode of traction had been so increased that there were then twenty-eight tugs running regularly between Hamburg and Aussig. These tugs are 138 to 150 feet long, 24 feet wide, with 18 inches draught. On the upper Elbe the average tow is from four to eight large barges, and, taking the ice into consideration, there are about three hundred towing-days in the year. Although Germany possesses a length of nearly 17,000 miles of navigable rivers, or more than double the combined length of the navigable streams of the United Kingdom and France, it cannot be said to be rich in canals. In South Germany the Regnitz and Ludwig canals, from the Main at Bamberg to the Danube, were the only ones of importance until the annexation of Alsace-Lorraine.

[1] From a lecture by Sir C. A. Hartley before the Institution of civil engineers.

Holland possesses the great advantage of holding the mouths of the Rhine, the Maas, and the Scheldt. Her means of river communication with Germany, France, and Belgium, are unbounded; and the possession of a length of 930 miles of canals and 340 miles of rivers enables her, apart from her railways, to carry on her large trade with greater facility of transport than, perhaps, any other European country.

Belgium shares with her northern neighbor the advantages of an elaborate system of waterways. By far the most important river is the Scheldt. Thanks to its unique position at the head of a tidal estuary, to the abolition of the Scheldt dues, and to the foresight and liberality of the Belgian government, which has spent $20,000,000 on dock and river works since 1877, Antwerp has now become in many respects the foremost port of the continent. Besides her 700 miles of navigable rivers, Belgium possesses about 540 miles of canals, by means of which communication exists between all the large towns and chief seaports of the kingdom.

France has built up, and is constantly extending, an elaborate system of canals and canalized rivers. Of the latter, the Seine is the most important in regard to the artificial works undertaken for its improvement, and for the tonnage of the traffic, which was in 1872 more than one-eighth of the whole waterborne traffic of France. The Loire, the Garonne, and the Rhone have all been largely benefited by the art of the engineer. The canal system of France is historic; one of the earliest of these artificial cuts being the celebrated canal of Languedoc, 171 miles long, built in 1667–81, and now forming part of the Canal du Midi. From its summit-level 600 feet above the sea, it communicates with the Garonne, and therefore with the Atlantic, by twenty-six locks, while its southern slope descends by seventy-three locks to the Mediterranean. Up to 1878, on 7,069 miles of waterways, France had spent upwards of $215,000,000. Nevertheless, it is intended still further to extend this means of communication at an estimated further cost of $200,000,000.

Spain and Portugal possess, partly in common, eight principal rivers, of which five — the Minho, Douro, Tagus, Guadiana, and Guadalquivir — drain the western valleys, and flow into the Atlantic; while the other three — the Ebro, Incar, and Segura — discharge into the Mediterranean. As a rule, these rivers are only navigable for a limited portion of their course, and are chiefly remarkable for extremes of flood-discharge; a velocity of sixteen knots an hour having been noted in the Douro under certain conditions of tide. The canals of the Iberian peninsula are unimportant. Spain possessed a length of 130 miles in 1875.

Italy is not rich in waterways except in the valley of the Po, the navigable portion of her rivers only attaining an aggregate length of 1,100 miles. Although the total length of navigable canals in Italy is only 435 miles, the Italians were the first people of modern Europe that attempted to plan and execute such artificial waterways. As a rule, however, they have been principally undertaken for the purposes of irrigation.

Austria-Hungary possesses in the Danube the largest river in Europe as regards the volume of discharge, although it is inferior to the Volga in the length of its course and the area of its basin. This great stream first becomes navigable for flat-bottomed boats at Ulm, 130 miles from its source. In its total length of 1,750 miles, it is fed by at least 300 tributaries, many of them large rivers. Although the Danube between Vienna and Old Moldova had been regulated in numerous places and at great cost, there had been but little appreciable improvement effected in its general navigable depth. On this account, projects having in view the permanent acquisition of a sufficiently wide channel, of from six to eight feet deep at every point between Passau and Basias, have lately been prepared, which involve an outlay of $10,000,000 to effect the desired improvements. Traffic on the upper and lower Danube is mostly carried in barges, of which the greater number gauge 250 tons. The effect of the improvements at the Sulina mouth has been to increase the trade from 680,000 tons gross in 1859, to 1,530,000 gross tons in 1883, and to lower the charges on shipping from an average of five dollars per ton for lighterage, to half a dollar per register ton at the present time for commission dues. As a commentary on the hostile criticism evoked when the scheme was initiated, the lecturer drew attention to two facts; namely, that the works so unsparingly criticised in 1857 had already effected a saving of $100,000,000, and that experience had abundantly proved that the predictions of a rapid silting-up to seaward of the Sulina piers had been completely erroneous.

THE GEOLOGY OF WISCONSIN.

THE nearly simultaneous appearance of the two final volumes of the 'Geology of Wisconsin' some months since, marked the close of one of the most rapid of the state geological surveys, and, for the time and money expended, one of the most thorough and complete. The work has been done in less detail than in some other states, whose surveys have run through much longer periods of time, and have consequently necessitated much greater financial outlays. The results are embodied in four large octavo volumes, containing something more than three thousand pages. The text is well illustrated; and the judicious use of cuts, which express much more than the best verbal descriptions occupying the same space, has contributed to the embodiment of a large amount of material in relatively small compass. In the same line may be noted the predominance of observational results over theoretical deductions, and the absence of irrelevant discussions which have sometimes served to swell

Geology of Wisconsin. Professor T. C. CHAMBERLIN, chief geologist. 4 vols. Madison, Wis., 1877–83. 3,147 p., 140 pl. 8°

similar publications. The accompanying atlas sheets, more than forty in number, add much to the value of the reports.

The leading contributors are Prof. T. C. Chamberlin, chief geologist, and Messrs. R. D. Irving, Moses Strong, R. P. Whitfield, Charles E. Wright, T. B. Brooks, E. T. Sweet, L. C. Wooster, and F. H. King. In connection with lithological determinations and reports, stand the names of Irving, Wichmann, Pumpelly, Van Hise, and Julien. Vol. i. also embraces reports on selected topics in natural history, notable among which is King's report on the economic relations of our birds.

A characteristic feature of the publications is the relatively large amount of practical information brought within the reach of the intelligent citizen who has little technical knowledge of science. Indeed, the oft-repeated question of which every geologist must be weary — 'What is the object of the survey?' — would hardly be asked by one familiar with the results of the survey of Wisconsin. In vol. i. appear several chapters of economic import, the express purpose of which is to make easy of comprehension the principles which are involved in such every-day matters as the sinking of artesian wells, the manufacture of brick, tile, etc., the selection of building-stone, the relations of soil to fertilizers, where and how to search for ore-deposits, — questions concerning which the opinion of the geologist is of practical worth.

Attention has throughout been directed to known mineral resources with a view to their future development, and particularly to those formations which, from their relationship to productive mineral-bearing formations elsewhere, or for other reasons, were thought, from an economic point of view, to merit careful investigation. The benefits, both positive and negative, which have accrued to the state as the result of such investigations, have already been considerable, and will doubtless be still greater in time to come. Other natural resources have not been neglected. Attention has been directed to various building-stones of considerable merit; and some of them, in consequence, have already found their way into the market. The subject of artesian wells has received special study at the hands of the chief geologist. It is doubtful if the problem of subterranean water-supply over a commensurate area of such diversity of character is anywhere better understood.

The survey has done more than assist in the development of natural resources, and its work is to be commended for other than economic

reasons. The science of geology has received no insignificant contribution in these publications. Much light has been thrown upon some unsettled problems; and if they are still unsettled, or if their solutions are still disputed, the contribution is not less real, because the data afforded by the state are insufficient bases for positive conclusions. Each formation of the state has been carefully mapped; its stratigraphical relations determined; and its fossils, when fossils exist, identified. Ninety-four new species are described and figured, as also are some of the more characteristic forms previously known.

Among the more important and interesting results are the determinations which have been made respecting the subdivisions of the archaean formation, and those which pertain to glacial geology. Concerning the former, the Wisconsin geologists recognize three distinct groups of rocks, — the Laurentian, Huronian, and Keweenawan. These groups, it is maintained, are not only distinct, but separated by intervals which, in point of time, were of no inconsiderable duration, — intervals long enough in each case to allow profound changes, both stratigraphical and petrographical, to be accomplished during their continuance. The evidence cited in support of this subdivision, as well as that bearing on the distinctness of the Keweenawan from the Potsdam formation above, is of a positive and perfectly definite character. The greatest break is held to occur between the Laurentian and Huronian series. The rocks of the Laurentian series are much more highly metamorphosed than those of the Huronian which overlie them; they are in a highly folded and contorted state, while the Huronian rocks have suffered notably less stratigraphical distortion; the laminations of the two series, when seen in contact or proximity, are discordant; the later series contains, at its very base, material from the older highly metamorphosed rocks; and the relations of the two series to penetrating igneous rocks are such as to emphasize the conclusion to which the other lines of evidence point. Altogether, the evidence upon which the subdivision is based is strong, and, for the region under consideration, is certainly convincing. The separation of the Keweenawan rocks from the Huronian on the one hand, and from the Potsdam on the other, rests on scarcely less positive grounds. The question as to whether the Keweenawan group is to be classed as Cambrian or pre-Cambrian, is one concerning which there remains room for doubt. In any event, the important fact developed is the existence of a distinct formation younger than the Huronian, and unconformably subjacent to the oldest formation of the interior known to contain Cambrian fossils.

At the other end of the geological series equally important advances have been made. For the study of quaternary geology, Wisconsin is an exceptionally good field, because of the proximity of driftless, old-drift, and new-drift areas. The determination in 1874, of the morainic character of the previously known 'Kettle Range' of eastern Wisconsin, gave a new impetus to the study of the drift phenomena. Following this important determination was the demonstration of the character of ice-movement in a relatively level region, as exemplified by the ice which occupied the Green-Bay valley. The proof of the lobation of the ice-margin followed, and the facts and principles here first developed have been the key to the explanation of glacial phenomena since studied from the Atlantic to Dakota. The determination of hitherto unsuspected moraines, and the connection of these with each other and with moraines previously known, but not known to have more than local developments, quickly followed in the wake of the first determinations in Wisconsin. Another result, scarcely less significant, was the recognition of two clearly differentiated ice-epochs in the glacial period, separated, according to Professor Chamberlin, by an interval which may not have been less than the time which has elapsed since the last. Although the existence of two ice-epochs is not yet universally admitted, the drift phenomena of Wisconsin, especially when considered in connection with like phenomena throughout the interior, place the hypothesis upon a substantial basis. Although later investigations have slightly modified the borders of the driftless area as mapped by the survey, the reality of its existence is beyond question; and it is just as certain that between this area and that bounded by the Kettle Moraine, which marks the limit of ice advanced in the second epoch, as interpreted by Professor Chamberlin, there is an area covered with glacial drift, which, as indicated by the greater amount of erosion which it has suffered, is of much less recent origin than that within the Kettle Moraine.

The consideration of the ore-deposits of south-western Wisconsin constitutes one of the more valuable portions of the reports. The author accepts the general conclusions concerning the manner of deposition reached by Whitney some years since, but works out the

theory much more in detail, and for the first time makes it complete. For this thoroughgoing treatment of the subject by the chief geologist, the excellent topographic and geologic work of Mr. Strong prepared the way.

Wisconsin is to be congratulated upon the successful completion of a work which in so many other states has had a different issue.

NORDENSKIÖLD'S ARCTIC INVESTIGATIONS.

When Baron Nordenskiöld retired in April, 1882, from the presidency of the Royal academy of sciences at Stockholm, he took for the subject of his address the story of the Zeni brothers. This address was published in Swedish in 1883; and in the same year he laid before the Congrès des Américanistes, at their session at Copenhagen, three of the early maps, illustrative, as he thought, of an early acquaintance with Greenland, posterior to the so-called Northman discovery in the tenth century, and earlier than the period of Columbus. These were the Zeni map of 1380 (1390?); a map of 1427, found in a manuscript of Ptolemy at Nancy; and the Donis map of the edition of Ptolemy, printed at Ulm in 1482. In the German version of Nordenskiöld's papers, which has recently appeared as 'Studien und forschungen,' we have this same Zeni study in a language easier read by most inquirers. Those who believe in the substantial truth of the Zeni narrative will find Nordenskiöld on their side. He identifies the Frisland of the story with the Faröe Islands, makes the Zeni to have reached Greenland, and identifies the Estotiland and Drogeo of the Frisland fisherman with our American coast from Newfoundland south.

The botanical portion of the book has been contributed by three writers, — Nathorst, Kjellman, and Wittrock, — who treat respectively of the former botanical geography of high latitudes as indicated by the results of polar research, the biology of the arctic flora, and the vegetable life of the naked snow and ice. All of these articles are remarkably free from technicality, and form pleasant and instructive reading, the last being especially valuable because of its full references to the literature of the subject.

Fossil collections made from time to time in the arctic region, and, for the most part, elaborated by Heer, when compared among themselves, and with similar collections from Europe, show a remarkable uniformity in the early flora of the entire northern part of the world, until, scattered and driven southward along numerous lines of migration, it has left its descendants mainly on the eastern sides of the two great continents, as Dr. Gray has already shown in his history of Sequoia.

For the most part, the present arctic flora is composed of the descendants of tertiary alpine species, which, wandering from their original homes, — the Alps, the mountains of Greenland and Scandinavia, the Caucasus, and the Altai and Rocky mountains, — were driven back, at the end of the glacial period, to high elevations, or into the circumpolar region, by the warmer climate which succeeded. The collections made by the returning Vega party at Mogi, in Japan, are interesting because they indicate a certain, though relatively slight, reduction in temperature in that part of Asia corresponding to the glaciation of America and Europe, though, as is well known, no traces of inland ice occur there.

The arctic flora of to-day is a most interesting subject for study. While the ocean, at a short distance from shore, supports a growth of giant kelps and dark Florideae, which manifest continued activity the year through, vegetating in the short summer, and pushing their reproductive processes during the long winter night, the land-plants are all pygmies, apparently less because they cannot endure the intense cold of winter, than because they do not enjoy sufficient warmth in summer to assimilate enough organic matter for any considerable growth.

In a region where the average daily temperature for the least cold month of summer is but a few degrees above the freezing-point, and where vegetation is practically limited to about two months of even this slight warmth, interesting adaptations are met with on every hand. Annuals are as good as unknown, the season proving too short for the development of their vegetative organs, and the subsequent maturation of fruit. The entire flora is practically biennial or perennial; the plants rapidly pushing into bloom, like our spring flora, with the first abatement of the cold of winter, yet, unlike the latter, barely fruiting, and elaborating material for the next year's flowers before the short summer is succeeded by another winter. Indeed, the season is too short for the majority of even these precocious and hardy plants, many of which are forced to rely on vegetative reproduction except in the most favored situations, while nearly all are caught in the midst of flowering by the cold of autumn, which

Studien und forschungen veranlasst durch meine reisen im Aohen norden. Von A. E. Nordenskiöld. Autoriste ausgabe. Leipzig, *Brockhaus*, 1885. 9+521 p., illustr., 8 pl., and maps. 8°.

blights them as a sudden frost nips the tender exotics of our gardens.

Yet, despite the desolation of the land in all save the most congenial localities, and the difficulty with which the plants growing in these perform their necessary functions, even the bare ice and snow are not without their life, no less than forty-two species or well-marked varieties of ice and snow plants being now known. As might be inferred from their habitat, these are mainly algae, though the alga-like protonemata of several mosses are found, and the occurrence of putrefaction to a slight extent argues the presence of bacteria. The essential characters of this flora, are, in brief, that it consists almost exclusively of water-plants of low organization, propagating themselves chiefly by non-sexual processes. These plants are all microscopic; yet, as they are for the most part brightly colored, characteristic tints — red, brownish-purple, and green — are often given to extensive areas of snow and ice by the myriads of these minute beings which occur together.

Under the title 'Insect-life in arctic lands,' Dr. Christopher Aurivillius gives an account of the expeditions which have enriched our knowledge of arctic insects, of the number of species of each order of insects collected, and of the literature of the subject. He explains that the uniformity of the arctic fauna becomes more striking as the north pole is approached, but that three subdivisions are recognizable: these he terms the Scandinavian arctic, the Asiatic arctic, and the American arctic regions. A brief notice of the influence of the retreating glacial sheet, in the past, in leaving colonies of arctic insects on mountains, — of which Mount Washington, N.H., is especially mentioned, — is followed by a discussion of the difference in relative proportion of species of the different orders of insects in arctic and temperate lands, and the causes of this unequal distribution. Insect metamorphoses are stated to take longer time in arctic than in temperate lands; Oeneis Bore requiring two years to complete its changes, passing from five to six weeks as a subterranean pupa. The co-ordinate development of plants and insects in geological time, especially the correspondence in the development of suctorial mouth-parts of insects and of flowers with concealed or not easily accessible honey, is outlined; and the relationship of the distribution of arctic insects to the arctic flora is illustrated by a tabular synopsis of the nature of the flowers, and the distribution of different arctic plants. This synopsis shows that anemophilous flowers diminish in number toward the north, and that the flowers fertilized by flies, bees, and Lepidoptera, bear nearly direct relationship to the dipterous, hymenopterous, and lepidopterous fauna of each region. A few flowers, however, which are fertilized by bees farther south, are self-fertilized in the arctic regions: such are the flowers of the two species of Pedicularis found in Spitzbergen, where careful search has failed to discover humble-bees. The author uses this peculiarity of Pedicularis to show the inapplicability of Darwin's theory that the deterioriation of species by self-fertilization is an explanation of the origin of cross-fertilization by insects. Dr. Aurivillius shows, further, that the colors of arctic flowers tend to confirm what is known of the color-sense of the insects that visit them.

H. Hildebrand devotes nearly one hundred pages to a discussion of our knowledge of the art of the lower races of savage people, especially of the Chukchi, Eskimo, Bushmen, Australians, Melanesians, and the people of the stone age in western and northern Europe. He puts aside considerations based on physical or linguistic features, and discusses merely the aesthetic relations of the different people as evidenced by their more or less artistic productions. From this point of view, the people of Chukchi race, studied by the Vega party, are closely assimilated to the Eskimo; more so, indeed, than the pure race characteristics would justify: for it must not be forgotten that the bone-carvings and pictures of the so-called 'sedentary Chukchi' are mere copies borrowed from the art of the Eskimo, to whose mode of life the loss of their deer has driven a portion of a different people, whose normal development and culture away from the coast shows little or nothing of such art-work. Their stage of ethnic development is, however, much the same. The peculiarities of the art of people in this stage, whether exhibited by the quaternary specimens from the caves of Perigord, or those of the present day from Bering Strait, are to be ascribed to common features of aesthetic evolution in the mind of man, of which the rude pictures drawn by civilized children offer at once a reminiscence and an example.

In an article which covers ninety-four pages, Nordenskiöld himself considers the geological significance of the cosmical material which falls upon the earth's surface. The nebular hypothesis of Kant and Laplace is briefly outlined, and the arguments in favor of the existence of matter in the form of ether are advanced. The author believes that the

original etheriform mass of our solar system condensed to cosmical clouds; the solid particles aggregated, forming large rotating bodies like the earth, which continue to enlarge by the addition of cosmical material from without. It is claimed that many meteorites are simply aggregations of meteroic dust; and numerous examples of the precipitation of such matter are described. The suggestion that eruptive rocks may be derived from accumulations of this kind is of special interest, since by some authors meteoric and eruptive rocks are classed together.

NOTES AND NEWS.

In speaking of the benefit to be expected from the large telescope now building, Professor Asaph Hall recently said that we must not commit the common error of expecting too much from the use of such instruments. Measured by the relative amount of light gathered, the gain seems great; but, when we pass from a fifteen-inch objective to one of thirty inches in diameter, our gain in the visibility of stars is only one and a half magnitudes. It is true that the number of stars brought to view by the larger glass in the shell of our great celestial sphere is very great; but they are of the faintest kind, and the study of these stars is very laborious. And, moreover, all the obvious and striking discoveries of astronomy have been made long since.

— The fifty-fifth annual meeting of the British association, says *Nature*, will commence on Wednesday, Sept. 9, 1885, at Aberdeen. The president-elect is Sir Lyon Playfair. The vice-presidents are the Duke of Richmond and Gordon, the Earl of Aberdeen, the Earl of Crawford and Balcarres, James Matthews, Professor Sir William Thomson, Alexander Bain, the Very Rev. Principal Pirie, Prof. W. H. Flower; general treasurer, Prof. A. W. Williamson; general secretaries, Capt. Douglas Galton, A. G. Vernon Harcourt; secretary, Prof. T. G. Bonney; local secretaries, J. W. Crombie, Angus Fraser, Prof. G. Pirie; local treasurers, John Findlater, Robert Lumsden. The sectional officers are as follows: — *A. Mathematical and physical science:* president, Prof. G. Chrystal; vice-presidents, Prof. C. Niven, Prof. A. Schuster; secretaries, R. E. Baynes, R. T. Glazebrook, Prof. W. M. Hicks (recorder), Prof. W. Ingram. *B. Chemical science:* president, Prof. H. E. Armstrong; vice-presidents, Prof. A. Crum Brown, Prof. H. McLeod; secretaries, Prof. P. Phillips Bedson (recorder), H. B. Dixon, H. Forster Morley, W. J. Simpson. *C. Geology:* president, Prof. J. W. Judd; vice-presidents, John Evans, Prof. W. C. Williamson; secretaries, C. E. De Rance, J. Horne, J. J. H. Teall, W. Topley (recorder). *D. Biology:* president, Prof. W. C. McIntosh; vice-presidents, Prof. I. Bayley Balfour, Prof. J. S. Burdon Sanderson; secretaries, W. Heape, J. Duncan Matthews, Howard Saunders (recorder), H. Marshall Ward. *E. Geography:* president, Lieut.-Gen. J. T. Walker; vice-presidents, Professor James Donaldson, John Rae; secretaries, J. S. Keltie, J. S. O'Halloran, E. G. Ravenstein (recorder), Rev. G. A. Smith. *F. Economic science and statistics:* president, Professor Henry Sidgwick; vice-presidents, Prof. R. Adamson, Sir Rawson W. Rawson; secretaries, Rev. W. Cunningham, Prof. H. S. Foxwell (recorder), C. McCombie, M.A., J. F. Moss. *G. Mechanical science:* president, Benjamin Baker; vice-presidents, Prof. W. C. Unwin, Prof. H. C. Fleeming Jenkin; secretaries, A. T. Atchison (recorder), F. G. Ogilvie, R. Rigg, H. T. Wood. *H. Anthropology:* president, Francis Galton; vice-presidents, W. Pengelly, Prof. W. Turner; secretaries, G. W. Bloxam (recorder), J. G. Garson, Walter Hurst, A. MacGregor. The first general meeting will be held on Wednesday, Sept. 9, when Lord Rayleigh will resign the chair, and Sir Lyon Playfair, president-elect, will assume the presidency, and deliver an address. On Thursday evening, Sept. 10, there will be a *soirée;* on Friday evening, Sept. 11, a discourse by Prof. W. Grylls Adams; on Monday evening, Sept. 14, a discourse on 'The great ocean-basins,' by John Murray, director of the Challenger expedition commission; on Tuesday evening, Sept. 15, a *soirée.* On Wednesday, Sept. 16, the concluding general meeting will be held. The lecture to workingmen will be on the 'Nature of explosions,' by Mr. H. B. Dixon.

— There has just appeared an index to the first thirty volumes of Pflüger's *Archiv für die gesammte physiologie,* the most important physiological periodical of the world. The contributors include a large majority of the well-known professional physiologists of all countries, and number, altogether, in the neighborhood of six hundred. Most of the names are German, but a remarkable proportion are Russian. Among those whose articles are most numerous, we find W. Engelmann, Heidenhain, Hermann, Luchsinger, Pflüger, Valentin, and Worm-Müller. Although the *Archiv* has been edited with little supervision as to the real merit of the papers, and contains therefore an undue proportion of inferior essays, it still remains the most important single repository of modern physiological research; and the index will be of constant value in rendering the stores it contains more accessible. We commit, we hope, no breach of confidence in stating that the index is due to the well-applied skill and patience of an able American physiologist, who was long associated with Professor Pflüger at Bonn.

— A botanical congress will be held during the Antwerp exhibition, dealing principally with the plant kingdom of the Kongo district. With this view, a Belgian *savant* has drawn up a list of questions, and sent them to be answered at the various cultivation stations of the International society.

— The University of Nebraska is to have a new chemical laboratory, which will furnish accommodations for eighty students in the general laboratory, and for thirty-two in the laboratory for qualitative analysis, besides lecture-rooms and minor laboratories for quantitative work, gas analysis, and assaying.